

This listing of claims will replace all prior versions, and listings, of claims in the application

LISTING OF CLAIMS

1-5. (canceled).

6. (new) A method of forming a thin film, comprising:

in an intermediate thin film forming step, sputtering a target comprising at least one type of metal to form an intermediate thin film comprising the metal or an incomplete reactant of the metal onto a substrate;

in a film composition converting step, bringing the formed intermediate thin film into an active seed of a reactive gas mixed with an inactive gas having a chemically inactive property in such a manner that the intermediate thin film is reacted with the active seed of the reactive gas, and converted into a compound of the metal; and

in an optical characteristic adjusting step,

repeatedly conveying a substrate holder between a zone to perform the intermediate thin film forming step and a zone to perform the film composition converting step while controlling a conveying speed of the substrate holder for holding the substrate,

repeatedly performing the intermediate thin film formation and the film composition conversion, and

accordingly adjusting a film composition of a finally formed thin film to form the thin film having an optical characteristic value of a region where a hysteresis phenomenon occurs in which a change route of the optical characteristic value differs with a reactive gas flow rate in a case where a flow rate of the

reactive gas is increased and a case where the flow rate is decreased.

7. (new) The thin film forming method according to claim 6, wherein the optical characteristic adjusting step comprises:

at least one of rotating and driving the substrate holder holding the substrate on an outer peripheral face and having a cylindrical or hollow polygonal columnar shape; and

controlling a rotation speed of the substrate holder to form the thin film having the optical characteristic value in the region where the hysteresis phenomenon occurs.

8. (new) The thin film forming method according to claim 6, wherein the region where the hysteresis phenomenon occurs is a region of the optical characteristic value of the thin film formed when the reactive gas introduced in performing the sputtering has a flow rate of 15 sccm or less, which does not include 0 sccm.

9. (new) A thin film forming apparatus comprising:

a substrate holder which is disposed in a vacuum tank and which holds a substrate;

a film formation process zone which is disposed in the vacuum tank and in which sputtering is performed with respect to a target comprising at least one type of metal to form an intermediate thin film on the substrate;

a reaction process zone comprising an active seed generator for generating an active seed of a reactive gas, and disposed in the

vacuum tank, in which the intermediate thin film is reacted with the active seed of the reactive gas to form a thin film;

a partitioning mechanism for spatially separating the film formation process zone and the reaction process zone from each other;

~~a substrate holder driver for driving the substrate holder in order to convey the substrate between a position facing the film formation process zone and a position facing the reaction process zone; and~~

substrate holder conveying speed controller for controlling the substrate holder driver in a range configured to form the thin film having an optical characteristic value in a region where a hysteresis phenomenon occurs in which a change route of the optical characteristic value differs with respect to a reactive gas flow rate in a case where the flow rate of the reactive gas is increased and in a case where the rate is decreased.

10. (new) The thin film forming apparatus according to claim 4, wherein the region where the hysteresis phenomenon occurs is a region of the optical characteristic value of the thin film formed when the reactive gas introduced in performing the sputtering has a flow rate of 15 sccm or less, which does not include 0 sccm.